PTO 09-2945

CC=JP
DATE=19990212
KIND=Kokai
PN=11040937

SOLDER SUPPLY METHOD AND SOLDER SUPPLY APPARATUS
[Handa Kyokyu Hoho Oyobi Handa Kyokyu Sochi]

Kimihito Kuwabara et al.

UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. FEBRUARY 2009
TRANSLATED BY Schreiber Translations, Inc.

PUBLICATION COUNTRY	(10):	Japan
DOCUMENT NUMBER	(11):	11040937
DOCUMENT KIND	(12):	Kokai
PUBLICATION DATE	(43):	19990212
APPLICATION NUMBER	(21):	09197342
APPLICATION DATE	(22):	19970723
INTERNATIONAL CLASSIFICATION	(51):	H 05 K 3/34
PRIORITY COUNTRY	(33):	
PRIORITY NUMBER	(31):	
PRIORITY DATE	(32):	
INVENTOR(S)	(72):	Kimihito Kuwabara et al.
APPLICANT(S)	(71):	Matsushita Electric Industrial Co., Ltd.
DESIGNATED CONTRACTING STATES	(81):	
TITLE	(54):	SOLDER SUPPLY METHOD AND SOLDER SUPPLY APPARATUS
FOREIGN TITLE	[54A]:	Handa Kyokyu Hoho Oyobi Handa Kyokyu Sochi

/2[1]

Claims

1. A solder supply method, characterized by the fact that in a solder supply method that supplies a solder in accordance with conductor patterns arranged on a circuit substrate, a mask in which aperture parts corresponding to the conductor patterns of the above-mentioned circuit substrate are formed is closely adhered and installed on the above-mentioned circuit substrate; a molten solder is filled in the aperture parts of the above-mentioned mask; and the solder is supplied to the above-mentioned conductor patterns.

2. A solder supply method, characterized by the fact that in a solder supply method that supplies a solder in accordance with conductor patterns arranged on a circuit substrate, a mask in which aperture parts corresponding to the conductor patterns of the above-mentioned circuit substrate are formed is closely adhered and installed on the above-mentioned circuit substrate; a solder is melted in a solder pot equipped with a slit nozzle having an aperture with a slender slit shape at the tip by heating;

[1] Numbers in the margin indicate pagination in the foreign text.

the above-mentioned slit nozzle is pressed against the upper surface of the above-mentioned mask; a pressure is applied to the molten solder in the above-mentioned solder pot; the slit nozzle is moved in the horizontal direction on the above-mentioned mask while extruding the molten solder from the aperture of the above-mentioned slit nozzle; and the solder is supplied to the conductor patterns on the above-mentioned circuit substrate by filling the molten solder in the aperture parts of the above-mentioned mask.

3. A solder supply method, characterized by the fact that in a solder supply method that supplies a solder in accordance with conductor patterns arranged on a circuit substrate, a mask in which aperture parts corresponding to the conductor patterns of the above-mentioned circuit substrate are formed is closely adhered and installed on the above-mentioned circuit substrate; a solder is melted by heating in a solder pot in which the bottom face is constituted by a mesh having a fine aperture with a size to the degree the molten solder does not leak unless a pressure is applied; the bottom face of the above-mentioned solder pot is made to approach to the above-mentioned mask; a pressure is applied to the molten solder in the above-mentioned solder pot to jet the molten solder from the mesh

of the above-mentioned solder pot; and the solder is supplied to the conductor patterns on the above-mentioned circuit substrate by filling the molten solder in the aperture parts of the above-mentioned mask.

4. The solder supply method of any of Claims 1-3, characterized by the fact that in supplying the molten solder to the conductor patterns on the above-mentioned circuit substrate, an inert gas or a reducing gas is supplied between the above-mentioned mask and the molten solder supply part in the above-mentioned solder pot

5. The solder supply method of any of Claims 1-3, characterized by the fact that while contacting the molten solder supply part in the above-mentioned solder pot with the above-mentioned mask, the above-mentioned mask and the above-mentioned solder pot are positioned on the above-mentioned circuit substrate and integrated; the molten solder is supplied and spread on the conduct pattern on the above-mentioned circuit substrate in the integrated state; the above-mentioned mask is separated from the above-mentioned solder pot; and the above-mentioned mask is further separated from the circuit substrate.

6. The solder supply method of any of Claims 1-5, characterized by the fact that in supplying the molten solder to the conductor patterns on the above-mentioned

circuit substrate, an ultrasonic vibration is applied to the molten solder in the above-mentioned solder pot.

7. A solder supply apparatus, characterized by the fact that in a solder supply apparatus that supplies a solder in accordance with conductor patterns arranged on a circuit substrate, it is equipped with a means that closely adheres and installs a mask, in which aperture parts corresponding to the conductor patterns of the above-mentioned circuit substrate are formed, on the above-mentioned circuit substrate; a means that internally has a pot part for melting the solder by heating and a solder supply part which contacts the upper surface of the above-mentioned mask and fills the molten solder in the aperture part of the mask; and a means that applies an extrusion pressure to the molten solder in the above-mentioned solder pot.

8. A solder supply apparatus, characterized by the fact that in a solder supply apparatus that supplies a solder in accordance with conductor patterns arranged on a circuit substrate, it is equipped with a means that closely adheres and installs a mask, in which aperture parts corresponding to the conductor patterns of the above-mentioned circuit substrate are formed, on the above-mentioned circuit substrate; a solder pot that internally

has a pot part for melting the solder by heating and a slit nozzle having an aperture part with a slender slit shape being pressed against the upper surface of the above-mentioned mask; a means that supplies a pressure to the molten solder in the above-mentioned solder pot to extrude the molten solder into the aperture part of the mask from the aperture part of the above-mentioned slit nozzle; and a means that moves the above-mentioned slit nozzle in the horizontal direction on the above-mentioned mask.

9. A solder supply apparatus, characterized by the fact that in a solder supply apparatus that supplies a solder in accordance with conductor patterns arranged on a circuit substrate, it is equipped with a means that closely adheres and installs a mask, in which aperture parts corresponding to the conductor patterns of the above-mentioned circuit substrate are formed, on the above-mentioned circuit substrate; a solder pot that internally has a pot for melting the solder by heating and a mesh-shaped bottom face having a fine aperture with a size to the degree that the molten solder dose not leak unless an external pressure is applied to the bottom face; and a means that applies a pressure to the molten solder in the above-mentioned solder pot to jet the molten solder into

the aperture part of the mask from the mesh-shaped bottom face of the above-mentioned solder pot.

10. The solder supply apparatus of Claim 9, characterized by the fact that the bottom face of the above-mentioned solder pot is constituted by a perforated plate having several fine holes with a size to the degree that the molten solder does not leak.

11. The solder supply apparatus of any of Claims 7-10, characterized by the fact that the aperture in the molten solder supply part of the above-mentioned solder pot is formed so that the molten solder can be supplied to only the same position as the aperture part of the above-mentioned mask corresponding to the conductor patterns on the above-mentioned circuit substrate.

12. The solder supply apparatus of any of Claims 7-11, characterized by the fact that for supplying the molten solder to the conductor patterns on the above-mentioned circuit substrate, a means for supplying an inert gas or a reducing gas between the above-mentioned mask and the molten solder supply part in the above-mentioned solder pot is provided.

/3

13. A solder supply apparatus, characterized by the fact that in a solder supply apparatus that supplies a

solder in accordance with conductor patterns arranged on a circuit substrate, it is equipped with a means having a molten solder supply part that positions and integrates a mask, in which apertures corresponding to the conductor patterns of the above-mentioned circuit substrate are formed, with a solder pot for melting the solder by heating and supplies the molten solder from the aperture part of the above-mentioned mask to the conductor patterns on the above-mentioned circuit substrate in the integrated state; and a means for supplying an extrusion pressure to the molten solder in the above-mentioned pot.

14. The solder supply apparatus of Claim 13, characterized by the fact that the above-mentioned mask is fixed to the above-mentioned solder pot.

15. The solder supply apparatus of any of Claims 7-14, characterized by the fact that the aperture part of the above-mentioned mask is a stepped through hole; as its sectional shape, the molten solder side in the above-mentioned aperture part has a fine diameter to the degree that the molten solder does not leak unless an external pressure is applied; and the circuit substrate side in the aperture part has a diameter greater than the above-mentioned aperture with a fine diameter.

16. The solder supply apparatus of any of Claims 7-14, characterized by the fact that the aperture part of the above-mentioned mask is a tapered through hole; and as its sectional shape, the molten solder side in the above-mentioned aperture part has a triangular shape with a fine diameter to the degree that the molten solder does not leak unless an external pressure is applied.

17. The solder supply apparatus of any of Claims 7-16, characterized by the fact that the above-mentioned mask is formed of an alloy material with a small thermal expansion.

18. The solder supply apparatus of any of Claims 7-14, characterized by the fact that a piston for pressurizing the molten solder to the above-mentioned solder pot is installed in a vertically movable way.

19. The solder supply apparatus of any of Claims 7-14, characterized by the fact that it is equipped with a vibrating member for improving the wettability of the solder to the conductor patterns by applying an ultrasonic vibration to the molten solder in the above-mentioned solder pot.

20. The solder supply apparatus of any of Claims 7-19, characterized by the fact that a water-repellent working is applied to the aperture parts of the above-

mentioned mask or the aperture in the molten solder supply part of the above-mentioned solder pot.

Detailed explanation of the invention

[0001]

(Technical field of the invention)

The present invention pertains to a solder supply method and a solder supply apparatus that are applied to supply a preliminary solder to a circuit substrate and to form solder balls and bumps of electronic components.

[0002]

(Prior art)

As a first method of a conventional preliminary solder supply method to a printed-circuit board, as shown in Figures 31(a)-(c), there is a method that spread a flux 3 on conductor patterns 2 formed on a printed-circuit board 1 (Figure 31(a)), melts a wire solder 21 by a soldering iron (20) (Figure 31(b)), and supplies a solder 23 onto the conductor patter 2 on the printed-circuit board 1 (Figure 31(c)).

[0003] In addition, as a second method, there is also a method that jets a molten solder, passes only a printed-circuit board through a jet solder apparatus for solder-joining electronic components and the printed-circuit

board, wet-attaches the solder to conductor pattern parts of the printed-circuit board, and solves solder bridges in narrow pitch pattern parts by blowing a compressive air from a slit so that unnecessary solders are jumped.

[0004] Moreover, as a third method, there is also a general preliminary solder supply method that prints a cream solder in which powder-shaped solder particles with a flux are kneaded into a paste shape by a stencil printing plate printing method.

[0005] In other words, as shown in Figures 32(a)-(e), first, a metal mask 5 (Figure 32(a)) made of stainless steel or nickel with a thickness of about 150 mm in which aperture parts 5a corresponding to conductor patterns on the printed-circuit board is closely adhered onto the printed-circuit board 1 so that the aperture parts 5a and the conductor patterns 2 of the printed-circuit board 1 are fitted (Figure 32(b)). Next, the cream solder 22 composed of the powder-shaped solder particles and the flux as mentioned above is pressed into the aperture parts 5a of the metal mask 5 by a squeegee 25, and the extra cream solder 22 on the metal mask 5 is scratched off (Figure 32(c)). Next, the cream solder 22 is supplied in accordance with the conductor patterns 2 on the printed-circuit board 1 by separating the metal mask 5 from the

printed-circuit board 1 (Figure 32(d)). The printed-circuit board 1 is then put into reflow furnace, etc., and heated, and the cream solder 22 is melted, so that the preliminary solder supply of the metal solder 12 is carried out (Figure 32(e)).

[0006]

(Problems to be solved by the invention)

However, there are following problems in the above-mentioned conventional solder supply methods.

[0007] In other words, in the first method, since a similar work is required for each of the individual conductor patterns, the work efficiency is poor, and scattering is caused in the solder for each pad of the conductor patterns.

[0008] In addition, like the second method, in the method that collectively coats a molten solder on a substrate by using the jet solder of the a flow soldering apparatus, the solder supply to fine conductor patterns is difficult, though the production efficiency is good. In case only an air knife effect using a compressive air is utilized, there are also problems such as solder bridge inferiorities and large scattering of the amount of solder in patterns with a pitch of 0.5 mm or smaller.

[0009] Furthermore, like the third method, in case the cream solder is supplied to prescribed positions by using a metal mask, in order to favorably separate the metal mask after filling the cream solder in the aperture parts of the metal mask, the ratio of the thickness of the cream solder layer to the pad width of the conductor patterns is set to about 0.8 as a limit since the separation is deteriorated /4 in a too thick metal mask to the conductor pattern width. There is thus a limitation in the miniaturization of the size for the purpose of the solder printing of fine pattern parts with a pitch of 0.2 mm or smaller or the formation of solder balls.

[0010] In addition, the solder particles being included in the cream solder are not completely cohered but remain in the vicinity of the conductor patterns of the substrate, so that an electric short circuit on the circuit is likely to be caused.

[0011] Moreover, in the solder bump formation with a fine size, since the diameter of the solder particles being included in the cream solder is 20-40 μm, the metal mask cannot be smoothly separated from pads with a pitch of 200 μm or smaller, or scattering is caused in the amount of

solder being filled in the aperture parts of the metal mask.

[0012] Accordingly, the purpose of the present invention is to solve the above-mentioned conventional problems and to provide a solder supply method and a solder supply apparatus that can supply a fine preliminary solder onto prescribed conductor patterns with high production efficiency or can stably form solder balls or solder bumps.

[0013]

(Means to solve the problems)

In order to achieve the above-mentioned purpose, the present invention provides a solder supply method, which closely adheres a mask in which aperture parts corresponding to conductor patterns on a circuit substrate or a component are formed and fills a molten solder in the aperture parts of the mask by applying a pressure, and an apparatus for applying the method. A prescribed amount of solder can be sampled by spreading the molten solder via the mask corresponding to the conductor patterns, so that a solder supply with little scattering of the amount of solder is realized. In addition, the molten solder being used has low viscosity, compared with the cream solder, can be jetted from a fine hole, and can be supplied to patterns with a fine pitch.

[0014]

(Embodiments of the invention)

Next, preferred embodiments of the present invention will be explained based on the figures.

[0015] Figures 1-6 are illustrative diagrams showing the constitution of the solder supply apparatus and the solder supply processes for explaining a first embodiment of the present invention. A circuit substrate 1 has a constitution in which conductor patterns 2 are formed on the surface (Figure 1). Next, in the solder supply process, a flux 3 is spread on the circuit substrate 1 by a flux dispenser 4 (Figure 2). A mask 5 in which aperture parts 6 corresponding to the conductor patterns 2 are formed is then closely adhered onto the circuit substrate 1 through the alignment of the conductor patterns and the aperture parts 6 by a mask movement means 30 (Figure 3). However, the flux may also be spread after the mask 5 is aligned on the circuit substrate 1 and closely adhered. In this case, the flux is supplied only to the aperture parts 6 of the mask 5.

[0016] On the other hand, in a solder pot 8, a solder is heated by a heater 9 and stored in a molten solder 7 in it, and a slit nozzle 10 as a molten solder supply part in which a slit aperture for jetting the molten solder 7 is

installed below the solder pot 8. The slit nozzle 10 of the solder pot 8 contacts with the mask closely adhered and installed on the circuit substrate 1. A compressive gas 15, for example, an inert gas such as N_2 gas and Ar gas or a reducing gas such as N_2 gas or an air is injected into the solder pot 7 from a compressive gas supply means 31. If N_2 gas is used, the oxidation of the solder is prevented, and clogging can be reduced. The molten solder 7 in the solder pot 8 is jetted from the slit nozzle 10 and injected into the aperture parts 6 of the mask 5.

[0017] The solder pot 8 is heated by the heater 9 so that the solder 11 jetted to the aperture parts 6 is not cooled and solidified. The heating temperature is set to the melting point of 183°C in an eutectic solder and 250°C or higher when jetting from the pot. The solder 11 jetted is wet-attached to the conductor patterns 2 of the circuit substrate 1 via the flux. Next, the solder pot 8 and the slit nozzle 10 are horizontally, continuously moved by a pot movement means 33 while blowing N_2 gas 24 on the mask 5 from a N_2 gas supply means 32 (Figure 4).

[0018] The non-solidified solder 11 is branched into the slit nozzle 10 side and the side filled in the aperture parts 6 of the mask 5 by the surface tension, and the solder 11 is spread on all the conductor patterns 2 on the

circuit substrate 1. The part except for the conductor patterns has no aperture of the mask 5 and is covered with the mask 5, it is not soldered.

[0019] In addition, since the amount of solder 11 being wet-attached to the conductor patterns 2 is determined by the capacity of the aperture parts 6 of the mask 5 installed on the conductor patterns 2, a stable amount of solder can be supplied.

[0020] Next, the solder pot 8 is separated from the mask 5 by the mask movement means 30. The solder spread on the circuit substrate 1 is thus solidified and becomes a metal solder 12, and the mask 5 is pulled off from the substrate (Figure 5), so that the solder supply to the conductor patterns 2 of the circuit substrate 1 is completed (Figure 6). In addition, in the grid formation of solder balls of BGA and CSP packages, a treatment for shaping a ball shape is carried out once more through a reflow furnace.

[0021] As for the method for supplying the molten solder 7 to the aperture parts 6 via the mask 5, instead of the method and constitution that moves the slit nozzle 10 for jetting the molten solder in the horizontal direction and continuously fills and attaches the molten solder as explained based on Figures 1-6, there is also a method that collectively, simultaneously supplies the solder to all the

aperture parts 6 of the mask 5 by using a solder pot 8′ having a bottom face with an area or larger for spreading the solder, which will be mentioned later.

[0022] Figures 7-15 are illustrative diagrams showing the constitution of the solder supply apparatus and the solder supply processes for explaining a second embodiment of the present invention that collectively, simultaneously supply

/5

a solder to all aperture parts of a mask as mentioned above. Here, the same symbols will be given to members corresponding to the members explained above, and their detailed explanation will be omitted.

[0023] First, similarly to the explanation in the first embodiment, the flux 3 is spread on the conductor patterns 2 on the circuit substrate 1 (Figures 7 and 8), and the mask 5 is closely adhered so that the aperture parts 6 correspond to the conductor patterns 2 (Figure 9). Next, the solder pot 8′ is vertically pressed against the upper surface of the mask 5. In the solder pot 8′, the solder is changed to the molten solder 7 by the heater 9 and stored. The bottom face of the solder pot 8′ becomes a mesh nozzle 13 (Figure 10).

[0024] The bottom face of the solder pot 8′, as shown in Figure 16(a), is the mesh nozzle 13 having fine apertures,

and due to the surface tension, the molten solder 7 is not dropped (leaked) by its own weight unless a pressure is applied by compressive air, etc., from the top. If a water-repellent plating such as Teflon (trade name) is applied to the mesh nozzle 13 by a chemical plating or electroplating, the leak of the molten solder to the mesh nozzle 13 is reduced, so that the above-mentioned self-weight drop can be more effectively prevented.

[0025] Next, as shown in Figures 16(a) and 11, if a pressure P is applied from the upper surface of the molten solder 7, the molten solder 7 is jetted from each fine aperture part of the mesh nozzle 13 and filled in the aperture parts 6 of the mask 5. The filling in the aperture parts 6 is collectively, simultaneously carried out for all the conductor patterns 2. The molten solder 7 filled is wet-attached to the conductor patterns 2, and if the pressure is eliminated (Figures 16(c) and 12), the molten solder 7 is wetted on the upper surface of the mesh nozzle 13 and the conductor patterns 2 by its own surface tension, changed to a spherical surface shape in the aperture parts 6 of the mask 5, and separated, so that the solder 11 is collectively spread.

[0026] Next, as shown in Figures 13-15, while blowing N_2 gas on the mask 5, the solder pot 8' and the mesh nozzle 13 are

pulled off from the mask 5, and the mask 5 is pulled off, so that the supply of the metal solder onto the conductor patterns 2 in the circuit substrate 1 is completed.

[0027] In addition, as the constitution of the mesh nozzle 13 constituting the bottom face of the solder pot 8', the mesh on a wire net shown in Figure 17(a) or a perforated metal having apertures shown in Figure 17(b) may be adopted. The material of the mesh nozzle 13 is an alloy with a small thermal expansion such as stainless steel or Invar, can be finely worked, and may undergo a surface treatment for preventing wetting on the solder. In addition, even in a high-temperature environment at 250°C or higher, heat-resistant polyimide resin, etc., can also be adopted.

[0028] According to the solder spreading of the method and constitution in the second embodiment, compared with the method and constitution in the first embodiment, a collective spreading for accelerating the treatment is possible, and a solder supply with high production efficiency can be realized.

[0029] Figures 18-26 are illustrative diagrams showing the constitution of the solder supply apparatus and the solder supply processes for explaining a third embodiment of the present invention.

[0030] The third embodiment is different in the structure of the solder pot and the solder supply from the second embodiment, and the other constitutions are basically similar to those of the second embodiment. As shown in Figures 18-20, the flux 3 is spread on the circuit substrate 1, and the mask 5 is closely adhered. As shown in Figure 21, from a solder pot 8″ in which a mask nozzle 14, wherein through holes 14a with a fine size to the degree that the molten solder 7 is not dropped by its own weight are formed, is constituted at the same position as the conductor patterns 2 of the circuit substrate 1 and the aperture parts 6 of the mask 5 on the bottom face, the molten solder 7 is collectively filled and supplied into the aperture parts 6 of the mask 6 (Figures 22 and 23).

[0031] Next, as shown in Figures 24-26, the solder pot 8″ is pulled off from the mask 5, and the mask 5 is pulled off, so that the supply of the metal solder onto the conductor patterns 2 in the circuit substrate 1 is completed.

[0032] In the third embodiment, the versatility of the solder pot 8″ is lost, however since the apertures for the outflow of the molten solder are installed in necessary parts, the amount of solder being filled can be regulated

with good precision, so that a stable solder supply can be realized.

[0033] As for the oxidation of the solder, as mentioned above, the oxidation can be prevented by supplying and filling N_2 gas between the mask 5 and the solder pots 8, 8′, and 8″.

[0034] In addition, it is also considered that the mask 5 and the solder pots 8, 8′, and 8″ are simultaneously closely adhered to the circuit substrate 1 and after the spreading treatment the molten solder 7, the mask 5 and the solder pots 8, 8′, and 8″ are simultaneously pulled off from the circuit substrate 1.

[0035] Figure 27 is a cross section showing the main parts of a solder pot 8″′ for explaining a fourth application example of the present invention. In the solder pot 8″′, the mask nozzle 14 is formed in the mask 5 and the mask is integrated with the bottom of the solder pot 8″′. The mask nozzle 14 in the example of Figure 27 consists of several stepped holes 20 in which the upper side of the mask 5 has a small diameter and the lower side has a large diameter. Figure 28 shows a modified example of the solder pot 8″′, and the difference from the example of Figure 27 is that the sectional shape of holes 21 constituting the mask nozzle 14 is a tapered shape. In these two examples, the

solder pot 8″′ is directly positioned for the conductor patterns 2 of the circuit substrate 1 after spreading the flux, and the molten solder 7 is spread while pressing.

[0036] In the solder pot 8″′ of the fourth embodiment, since the mask 5 is always at high temperature and heats the circuit substrate 1, troubles such as warp are apt to be caused by the generation of a thermal expansion in the circuit substrate 1. A too large size is thus difficult. However, the solder can be supplied with a simple structure.

/6

[0037] In addition, as the pressure for pressing the molten solder 7 into the aperture parts 6 of the mask 5, the molten solder 7 can also be pressed by vertically moving a piston 16 through a cylinder 17 as shown in Figure 29 in the solder pot 8″′ in addition to applying of a compressive into the solder pot.

[0038] Moreover, as shown in Figure 30, an ultrasonic vibrator 18 and a T type horn 19 are installed in the cylinder 17, and a cavitation is generated by applying an ultrasonic vibration to the molten solder in the solder pot 8″′. After setting the solder pot 8″′ and the mask 5 on the circuit substrate 1, the solder 11 is filled in the aperture parts 6 of the solder 5 by applying a pressure to

the molten solder 7. At that time, while raising the temperature of the solder pot 8″′ by heating via the heater 9 so that the molten solder 7 is not solidified, ultrasonic waves 26 are applied to the molten solder 7, so that oxide films on the surfaces of the conductor patterns 2 are broken, thereby favorably wetting the solder.

[0039] In this manner, the solder can be supplied without requiring the flux in advance or with a very small amount.

[0040] As explained by the above-mentioned each embodiment, according to these solder supply method and apparatus, in the method for supplying a prescribed amount of solder to prescribed positions on the circuit substrate, basically, the mask in which the aperture parts corresponding to the conductor patterns on the circuit substrate are formed is closely adhered onto the circuit substrate, the molten solder is filled in the aperture parts of the mask, and the solder is transferred and supplied to the conductor patterns by the wettability of the molten solder to the conductor patterns of the circuit substrate.

[0041] For this reason, the molten solder filled in the aperture parts of the mask is wetted and spread to pads of the conductor patterns, and the aperture parts of the mask suppress bridge inferiorities for the conductor patterns with a fine pitch. Next, if the pressure applied to the

molten solder is eliminated, the molten solder wet-attached to the conductor patterns and the molten solder on the mask are disintegrated by the surface tension, and the molten solder is transferred onto the conductor patterns.

[0042] Furthermore, with the adoption of the means for injecting the molten solder into the aperture parts of the mask through the solder pot with a bottom face having fine holes from the aperture parts of the mask, since the molten solder and the molten solder in the aperture parts of the mask wetted to the conductor patterns are separated in the fine holes of the bottom face of the solder pot, the amount of solder being supplied is further stabilized in proportion to the volume in the aperture parts of the mask.

[0043]

(Effects of the invention)

As explained above, according to the solder supply method and the solder supply apparatus of the present invention, a desired amount of solder can be sampled by spreading a molten solder via the mask corresponding to the conductor pattern, so that the solder can be supplied with little scattering of the amount of solder. In addition, since the molten solder has a viscosity as low as 1/1,000 or more, compared with the cream solder, the molten solder

can be jetted from a fine hole, so that the solder can be supplied to patterns with a fine pitch.

Brief description of the figures

Figure 1 is an illustrative diagrams showing the constitution of the solder supply apparatus and the first process of the solder supply for explaining a first embodiment of the present invention.

Figure 2 is an illustrative diagrams showing the constitution of the solder supply apparatus and the second process of the solder supply in the first embodiment of the present invention.

Figure 3 is an illustrative diagrams showing the constitution of the solder supply apparatus and the third process of the solder supply in the first embodiment of the present invention.

Figure 4 is an illustrative diagrams showing the constitution of the solder supply apparatus and the fourth process of the solder supply in the first embodiment of the present invention.

Figure 5 is an illustrative diagrams showing the constitution of the solder supply apparatus and the fifth process of the solder supply in the first embodiment of the present invention.

Figure 6 is an illustrative diagrams showing the constitution of the solder supply apparatus and the sixth process of the solder supply in the first embodiment of the present invention.

Figure 7 is an illustrative diagrams showing the constitution of the solder supply apparatus and the first process of the solder supply for explaining a second embodiment of the present invention.

Figure 8 is an illustrative diagrams showing the constitution of the solder supply apparatus and the second process of the solder supply in the second embodiment of the present invention.

Figure 9 is an illustrative diagrams showing the constitution of the solder supply apparatus and the third process of the solder supply in the second embodiment of the present invention.

Figure 10 is an illustrative diagrams showing the constitution of the solder supply apparatus and the fourth process of the solder supply in the second embodiment of the present invention.

Figure 11 is an illustrative diagrams showing the constitution of the solder supply apparatus and the fifth process of the solder supply in the second embodiment of the present invention.

Figure 12 is an illustrative diagrams showing the constitution of the solder supply apparatus and the sixth process of the solder supply in the second embodiment of the present invention.

Figure 13 is an illustrative diagrams showing the constitution of the solder supply apparatus and the seventh process of the solder supply for explaining the second embodiment of the present invention.

Figure 14 is an illustrative diagrams showing the constitution of the solder supply apparatus and the eighth process of the solder supply in the second embodiment of the present invention.

Figure 15 is an illustrative diagrams showing the constitution of the solder supply apparatus and the ninth process of the solder supply in the second embodiment of the present invention.

Figure 16 is an illustrative diagrams showing the movement of a molten solder in a mesh nozzle part in the solder supply apparatus in the second embodiment of the present invention.

Figure 17 is an oblique showing a constitutional example of the mesh nozzle.

Figure 18 is an illustrative diagrams showing the constitution of the solder supply apparatus and the first

process of the solder supply for explaining a third embodiment of the present invention.

Figure 19 is an illustrative diagrams showing the constitution of the solder supply apparatus and the second process of the solder supply in the third embodiment of the present invention.

Figure 20 is an illustrative diagrams showing the constitution of the solder supply apparatus and the third process of the solder supply in the third embodiment of the present invention.

Figure 21 is an illustrative diagrams showing the constitution of the solder supply apparatus and the fourth process of the solder supply in the third embodiment of the present invention.

Figure 22 is an illustrative diagrams showing the constitution of the solder supply apparatus and the fifth

/7

process of the solder supply in the third embodiment of the present invention.

Figure 23 is an illustrative diagrams showing the constitution of the solder supply apparatus and the sixth process of the solder supply in the third embodiment of the present invention.

Figure 24 is an illustrative diagrams showing the constitution of the solder supply apparatus and the seventh process of the solder supply in the third embodiment of the present invention.

Figure 25 is an illustrative diagrams showing the constitution of the solder supply apparatus and the eighth process of the solder supply in the third embodiment of the present invention.

Figure 26 is an illustrative diagrams showing the constitution of the solder supply apparatus and the ninth process of the solder supply in the third embodiment of the present invention.

Figure 27 is a cross section showing the main parts of a solder pot for explaining a fourth embodiment of the present invention.

Figure 28 is a cross section showing a modified example of the solder pot of Figure 27.

Figure 29 is an illustrative diagram showing the pressurization constitution to a molten solder in this embodiment.

Figure 30 is an illustrative diagram showing the pressurization constitution to a molten solder in this embodiment.

Figure 31 is an illustrative diagram showing a conventional preliminary solder supply method to a printed-circuit board.

Figure 32 is an illustrative diagram showing a conventional preliminary solder supply method to a printed-circuit board.

Explanation of symbols:

1 Circuit substrate

2 Conductor pattern

3 Flux

4 Flux dispenser

5 Mask

6 Aperture part of mask

7 Molten solder

8, 8′, 8″, 8″′ Solder pots

9 Heater

10 Slit nozzle

11 Solder

12 Metal solder

13 Mesh nozzle

14 Mask nozzle

16 Piston

17 Cylinder

18 Ultrasonic vibrator

19 Horn

30 Mask movement means

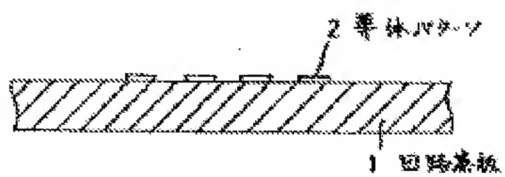
31 Compressive gas supply means

32 N_2 gas supply means

33 Pot movement means

// Insert Figures 1-32 //

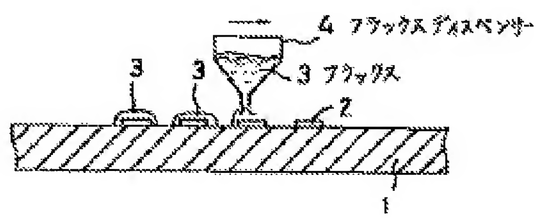
[Figure 1]



1 Circuit substrate

2 Conductor pattern

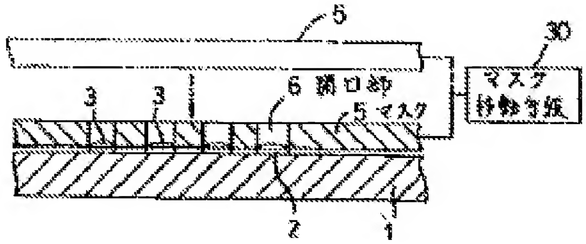
[Figure 2]



3 Flux

4 Flux dispenser

[Figure 3]

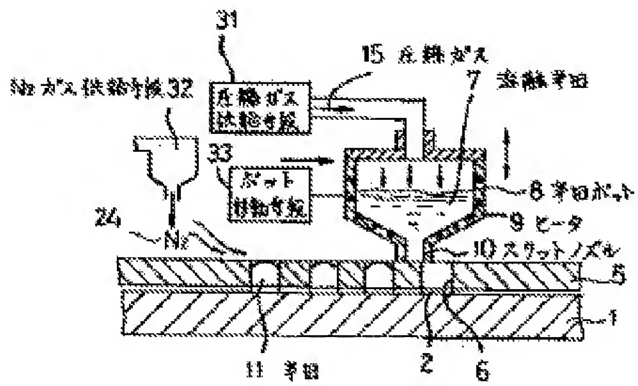


5 Mask

6 Aperture part

30 Mask movement means

[Figure 4]



7 Molten solder

8 Solder pot

9 Heater

10 Slit nozzle

11 Solder

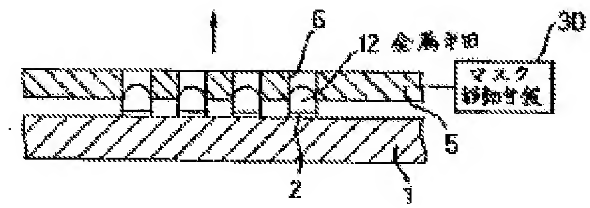
15 Compressive gas

31 Compressive gas supply means

32 N_2 gas supply means

33 Pot movement means

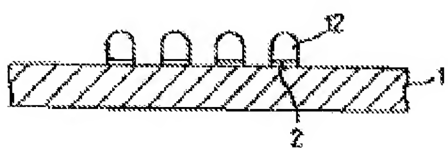
[Figure 5]



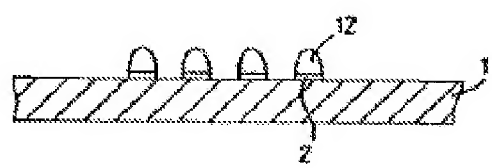
12 Metal solder

30 Mask movement means

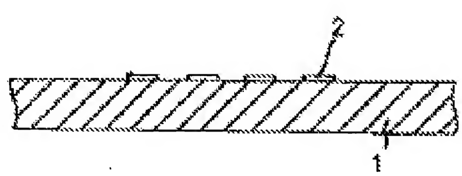
【図6】



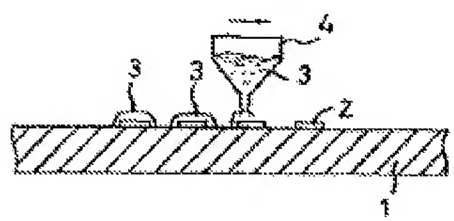
【図15】



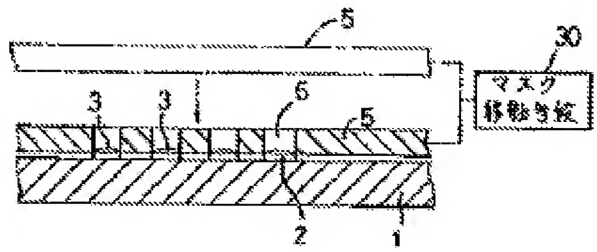
【図7】



【図8】

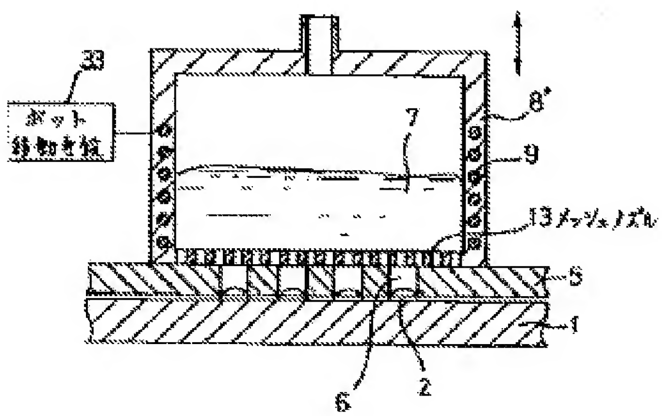


[Figure 9]



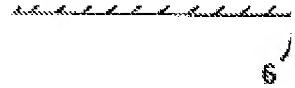
30 Mask movement means

[Figure 10]

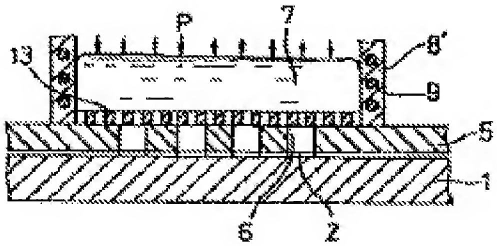


13 Mesh nozzle

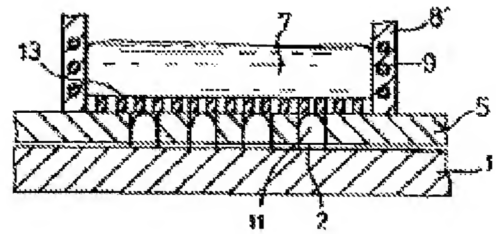
33 Hot movement means



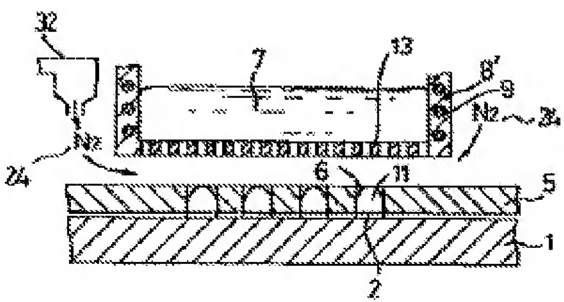
【図11】



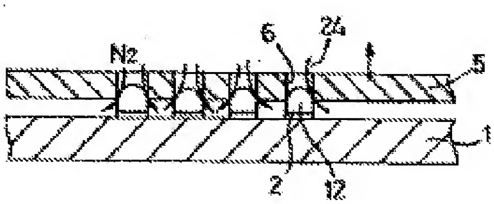
【図12】



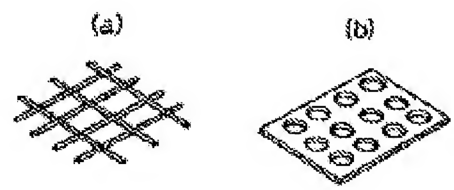
【図13】



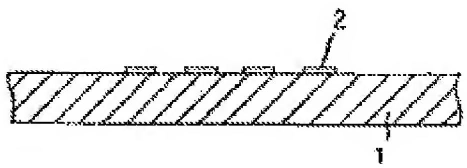
【図14】



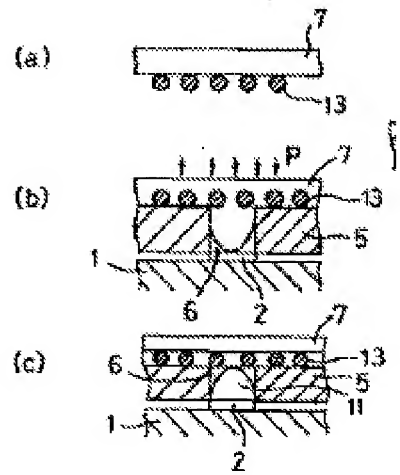
【図17】



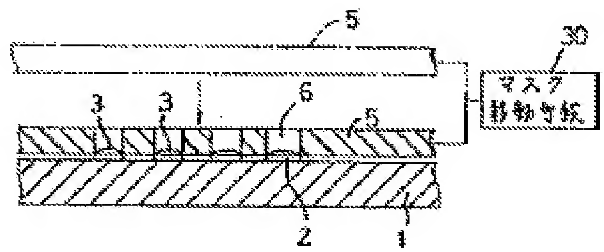
【図18】



【図16】

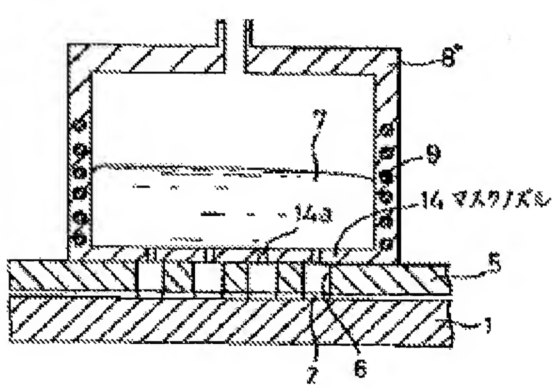


[Figure 20]



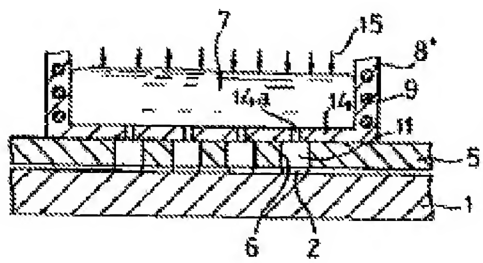
30   Mask movement means

[Figure 21]

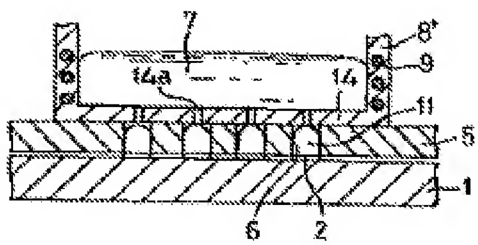


14　Mask nozzle

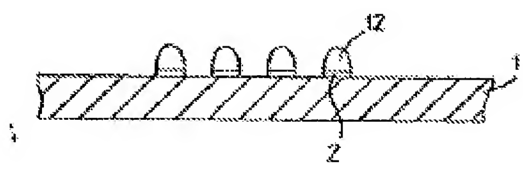
【図22】



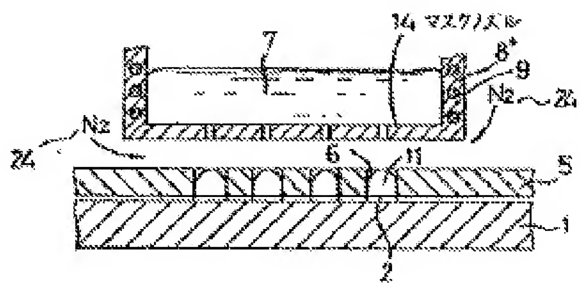
【図23】



【図26】

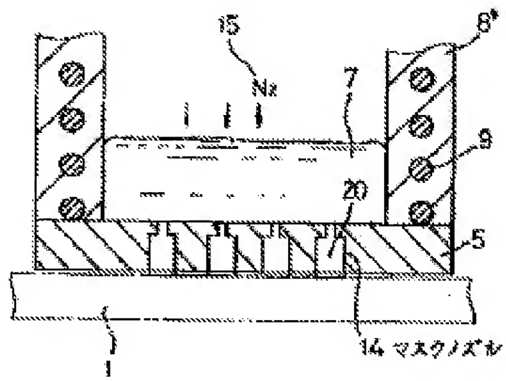


[Figure 24]



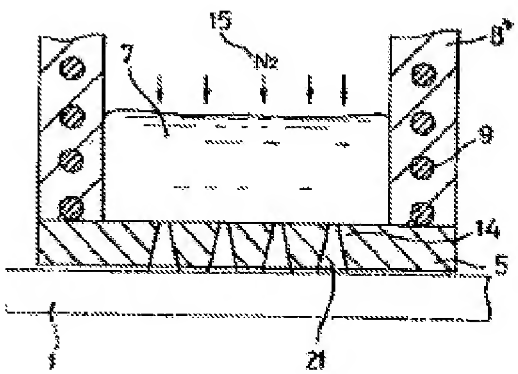
14　Mask nozzle

[Figure 27]

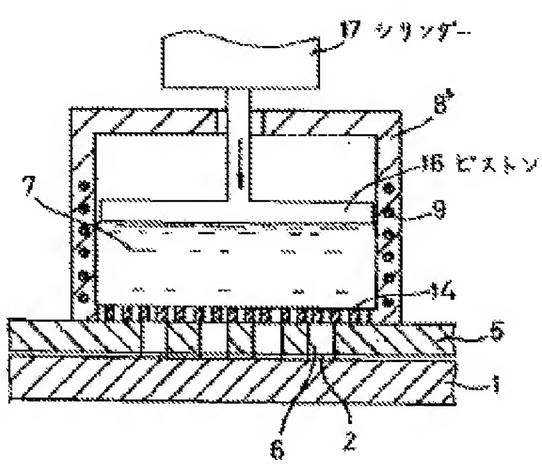


14 Mask nozzle

【図28】



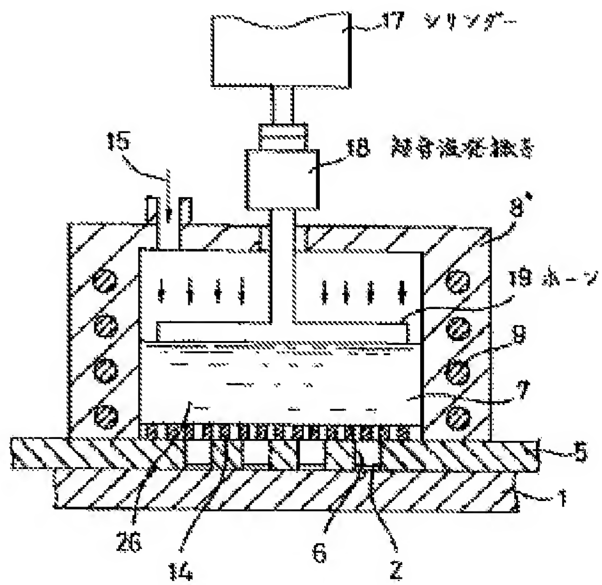
[Figure 29]



16 Piston

17 Cylinder

[Figure 30]



17 Cylinder

18 Ultrasonic vibrator

19 Horn